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A FEASIBILITY STUDY AND PROPOSED PROGRAMS ON APPLIANCE SERVICE TECHNOLOGY.

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RESPONSES FROM 60 PERCENT OF 190 APPLIANCE DISTRIBUTORS, RETAILERS, AND SERVICE ORGANIZATIONS SURVEYED BY QUESTIONNAIRE SHOWED THAT THERE WAS A NEED FOR TRAINED TECHNICAL PERSONNEL, WHO SHOULD HAVE SPECIAL SKILLS AND TRAINING AT THE POST-HIGH SCHOOL LEVEL. NEED FOR PRE-EMPLOYMENT AND POST-ENTRY TRAINING PROGRAMS WAS INDICATED. ORGANIZATIONS INDICATED WILLINGNESS TO SUPPORT SUCH A PROGRAM THROUGH CONSULTANT SERVICE, MONETARY GRANTS, RECRUITMENT OF STUDENTS, AND INSTRUCTIONAL AIDS. CURRICULUM GUIDES WERE INCLUDED FOR TECHNICAL ASPECTS OF THE PROGRAM AND IN RELATED FIELDS. (WO)

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APPLIANCE SERVICE TECHNOLOGY

Presented

by

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Lake Michigan College
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June 1965

PREFACE

This study, and the developed proposed appliance service technology training program, is considered to be phase I of the overall project supported by the W. K. Kellogg Foundation of Battle Creek, Michigan for the planning and implementation of an appliance service technology program at the post-high school level. The next phase of the project will include (1) a finalized training program; (2) production of material describing the training program and facilities and equipment needed to operate the program; and (3) the production of a guidebook for establishing an appliance service technology program. The last phase of the project is to include the final planning and probable implementation of an appliance service technology program at Lake Michigan College of Benton Harbor, Michigan.

June, 1965

C.H.S.

ACKNOWLEDGMENTS

Recognition and much gratitude is expressed to: Dr. R. E. Lahti, President of Lake Michigan College of Benton Harbor, Michigan, for his efforts in securing support for this study and his confidence; members of the Advisory Committee for their ideas, contributions, and evaluations so important to the study; and all personnel in appliance manufacturing and trade association organizations who devoted their time to assistance and cooperation in the gathering of their program information, supplying name lists of their service outlets, evaluation of proposed programs, and for other offered services.

Much appreciation is also expressed to: the W. K. Kellogg Foundation for the financial support given this project; and the personnel in all appliance manufacturer, distributor, retail, and service organizations for their time and willingness to cooperate and make this study possible.

A special thank you is extended to the writer's secretary, Mrs. Nancy Pallas, for her patience and cooperation in the miriad of correspondence, typing, mailings, and data collection required for this project.

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CHAPTER I

THE PROBLEM

Since the discovery of means to produce electricity, first indicated in the writings of the Greek Philosopher, Thales, (640 B.C. to 540 B.C.) who produced static electricity by rubbing a piece of amber, and the discovery of natural gas by the Chinese many thousands of years ago while boring holes into the earth in search of salt brine supply, much has developed in the utilization of these forms of energy. Some of the available and converted energy is now used to make our lives more leisurely and enjoyable in the modern appliances found and used in our offices, businesses, and homes. Predictions of ever-increasing demands for better and more complex appliances are commonplace and forecasts of some years ago of complete mechanization and climate control within our environment are beginning to become a reality.

There appears to be a possible need to train and supply a sizable number of technicians and specialized personnel to install and maintain the modern appliances which are becoming a necessity to our modern world.

The Purpose of the Study

The purpose of this study was (1) to determine the acceptance by appliance manufacturers of appliance service technicians as

employees, educational requirements of technicians, and acceptance of, or suggestions on, the proposed programs as developed; and (2) to determine the number of appliance technicians now being employed, the number needed over a seven-year period, employment of a technician as trained in the proposed programs, and possible interest in assisting in the initiation and operation of such a program by appliance distributors, retailers, and service organizations in Southwestern Michigan and contiguous Northern Indiana.

Even though a probable need exists in many areas of the United States for trained appliance service technicians, and many are being trained, the limitation that the feasibility of such a program of possible one to two year's duration, and the possible establishment thereof at Lake Michigan College of Benton Harbor, Michigan after two years, was adhered to as outlined in the proposal to the W. K. Kellogg Foundation for assistance in the study. This portion of the overall project was, therefore, limited to a proposed one- and two-year program, survey of appliance manufacturers in the nation, and appliance distributors, retailers and service organizations in the three Southwestern counties of Michigan and Northern Indiana which is contiguous to the aforementioned counties of Michigan.

The importance of the need for trained appliance service technicians, acceptance or rejection of, or suggestions on, a proposed training level for these technicians and what interest there may be on

the part of appliance manufacturers, distributors, retailers, and service organizations in helping to establish and/or operate a training program was deemed the significance of this study. The formulation of a guidebook containing suggested programs, basic course outlines, suggested physical facility lay-out, equipment, etc. for establishment of an appliance service technology program is considered to be the next phase of this overall project.

Definition of Terms

Appliance Service Technician. A person that installs, diagnoses problems, repairs and rebuilds large and small appliances in homes and business establishments.

Appliance Service Technology. A specialized training program in which the opportunity is presented for acquisition of basic information relating to the installation, repair and rebuilding of major and small appliances, customer relations and sales, and business operation techniques.

Organization of the Remainder of the Study

The rationale and procedures of the study are presented in Chapter II. The presentation and analysis of the data is summarized in Chapter III, and the summary, conclusions and recommendations are presented in Chapter IV.

CHAPTER II

RATIONALE AND PROCEDURES OF THE STUDY

The rationale and procedures for this study were divided into two phases--an appliance manufacturer and related associations phase and the distributors, retailers, and service organizations phase.

The Appliance Manufacturer and Related Associations Study

To develop the estimated need and qualifications for appliance service technicians in manufacturers' operations and to determine what interest there may be in trained appliance service technicians in the overall industry, initial contacts were made by correspondence with the manufacturers and associations as listed in Appendix A. With the interest expressed in possible further training of such personnel at the post high school level, a request was made of each of the organizations for information on training programs that each manufacturer may now be operating and a list of their respective distributors, retailers, and service organizations in Southwestern Michigan and contiguous Northern Indiana. The request for materials on operating service programs was made so that such could be reviewed and a proposed program could be written that would avoid, as much as possible, a duplication of training effort.

Upon receipt of materials on training programs existant in

manufacturers' organizations, plus others that are operated by public schools, etc., the Proposed One- and Two-Year Appliance Service Technology Program (see Appendix C) was written by the author. Visitations were made to the Emily Griffith Opportunity School of Denver, Colorado and the Southern Colorado State College in Pueblo, Colorado to review the programs being offered at these institutions.

A questionnaire (see Appendix B) was developed, seeking information from manufacturers on their present employment of appliance service technicians, how they are employed, educational requirements deemed necessary for employment, whether they would employ technicians as trained in the proposed programs, comments and/or suggestions on the proposed programs, and an expression of interest in helping to establish and maintain such a program. Each of the questions was specifically designed to elicit information which was deemed important relative to what is now existant in appliance service technology, what is considered important in further training of technicians, and what aid could be given to make the proposed training program the most valuable for all manufacturers and their service, distributor, and retail organizations of varied appliances.

An advisory committee was appointed (see Appendix A) which includes representatives of appliance manufacturers, distributors, retailers, and service organizations. Personnel in appliance manufacturing organizations not on the aforementioned advisory committee were

also considered as advisors in the study and will be further solicited for consultation in the later phase of this project.

The abovementioned advisory committee received the proposed programs, questionnaires, and correspondence. Suggestions for changes were made and the questionnaire, plus a copy of the proposed programs, was mailed to all manufacturers included in the listing in Appendix A. A 90% return of the questionnaires was realized and the data derived was hand tabulated and results are indicated in Chapter III.

The Distributors, Retailers and Service Organizations Study

To determine the number of appliance technicians employed, the number needed over a seven-year period, possible employment of a technician as trained in the proposed programs, and possible interest in assisting in the initiation and operation of such a program by appliance distributors, retailers, and service organizations, a questionnaire (see Appendix B) was developed. The criteria for development of this instrument were to determine the existant employment of appliance technicians, the estimated need for trained technicians, and possible assistance in initiating and operating a comprehensive, up-to-date appliance service technology program to meet the needs of the localized appliance industry.

The questionnaire was reviewed by the advisory committee and then mailed, along with copies of the proposed one- and two-year

programs, to 190 appliance distributors, retailers, and service organizations in three counties of Southwestern Michigan and contiguous Northern Indiana. With some 40% return of the questionnaires, a second mailing was made to those who had not responded to the first inquiry. This solicitation resulted in a 60% return which, when all adjustments were made in the mailing list for firms that had discontinued business operations or had discontinued appliance servicing, was considered an adequate sampling for this study. The data derived was hand tabulated and results are indicated in Chapter III.

CHAPTER III

PRESENTATION AND ANALYSIS OF THE DATA

In this chapter, an analysis of the data derived from questionnaires and personal contact with appliance manufacturers and associations, appliance distributors, retailers, and service organizations is presented. Data derived from each question, or statement, on both questionnaires is presented and analyzed.

The Appliance Manufacturers and Associations

The information discussed in this section was derived from responses to a series of questions and/or statements which will be presented and analyzed individually.

The first question asked of appliance manufacturers was:

We now employ Appliance Service Technicians.
( ) Yes ( ) No

There were 11 appliance manufacturers that indicated present employment of Appliance Service Technicians.

As a part of the above question, if the answer was "yes," it was deemed interesting to determine just how these manufacturers utilized their technician employees. Therefore, a request was made for categorization of type of employment in the statement:

They are employed as:
( ) Laboratory Technicians
( ) Product Design Change Analysts

( ) In manufacturing processes
( ) Sales personnel
( ) Production employees
( ) Other.....(specify)

Of the 11 manufacturers who stated that they employed Technicians, the employment designation was made as outlined in Table 1.

TABLE 1

EMPLOYMENT CATEGORIZATION OF APPLIANCE SERVICE TECHNICIANS BY APPLIANCE MANUFACTURERS

Number of Manufacturers	Technician Employment
4	Laboratory Technician
1	Product Design Change Analyst
2	In manufacturing processes
1	Production employees
9	Other

In Table 1, the technician employment category entitled "other" generally was specified as a technical and/or field representative.

The second question asked of appliance manufacturers was:

Educational requirements for employment as an Appliance Technician are:
( ) Less than high school graduate
( ) Less than high school graduate plus special training
( ) High school graduate plus special training and skills
( ) Two years of college
( ) Two-year community college associate degree in technology

( ) College graduate
( ) Other

The importance of this indication of training requirements was the assistance the derived information would provide in determining the necessity for a post high school training program and possible duration of said program. The educational requirements of responding manufacturers for Appliance Service Technicians are indicated in Table 2.

TABLE 2

EDUCATIONAL REQUIREMENTS FOR EMPLOYMENT
AS AN APPLIANCE SERVICE TECHNICIAN
IN APPLIANCE MANUFACTURING ORGANIZATIONS

Number of Manufacturers Requiring Specific Level of Educational Background	Educational Background Requirements
3	High school graduate
9	High school graduate plus special training and skills
2	Two years of college
1	Two-year community college associate degree in technology
2	College graduate

Generally, a minimum of a high school diploma plus special training was considered to be the educational requirements for employment as an

appliance service technician in appliance manufacturing organizations as indicated in Table 2. The two manufacturers requiring a college degree are employing their personnel as technical and/or field representatives. The results of this question indicate a need for training beyond the high school level for appliance service technicians.

In an attempt to determine the acceptability of the proposed Appliance Service Technology Program (see Appendix C), the request for a yes or no answer to a third statement was made. This statement was:

> We would employ a technician with training beyond high school as outlined in the attached proposed Appliance Service Technology Program.
> ( ) Yes ( ) No

Some eight manufacturers indicated that they would employ appliance service technicians as trained in the proposed programs. Two firms would not employ technicians with this training.

Allied to the above question, the fourth solicitation of information which can be helpful in designing and initiating a worthy appliance service technology program was in the statement:

> Suggestions or comments on the attached proposed Appliance Service Technology Program.

The recorded reaction to this query is indicated in the following comments:

1. "Excellent Program."
2. "Definite need--'Manager Technician.' Right approach to training 'Field Technicians.'"

3. "The course as proposed would, certainly, prepare the student in a wide range of service work."
4. "Parts inventory and planning needed."
5. "The program is excellent; however, more consideration should be given to management, inventory control, and merchandising methods."
6. "Good Program."
7. "Would support job location of qualified technicians."
8. "Graduates of proposed course could advance rapidly to service technicians and service managers."

Comments and suggestions for program revision will be considered in the next phase of this project. An indication of plausible approach to the training of appliance service technicians at the post-high school level was gleaned from the comments made.

The fifth, and last, query to the appliance manufacturers was deemed very important in the establishment and operation of a top-quality, up-to-date appliance service technology program. The statement solicitating information about possible help from appliance manufacturers to establish and operate such a program was:

> We would help establish and operate the proposed program by providing:
>
> ( ) New, or used, appliances and/or components for laboratory instruction and student manipulation.
> ( ) Instructional aids (cut-aways, charts, flow and wiring diagrams, etc.).
> ( ) New, or used, appliances for instructional and demonstration purposes.
> ( ) Monetary grants.
> ( ) Specialized personnel for consultation.
> ( ) Students or recruitment of students.
> ( ) Other.

Results from the above requested information are indicated in Table 3.

TABLE 3

ASSISTANCE BY MANUFACTURERS
TO ESTABLISH AND OPERATE
AN APPLIANCE SERVICE TECHNOLOGY PROGRAM

Number of Manufacturers that would assist	Type of Assistance
4	New, or used, appliances and/or components for laboratory instruction and student manipulation.
5	Instructional aids (cut-aways, charts, flow and wiring diagrams, etc.).
2	New, or used, appliances for instructional and demonstration purposes.
5	Specialized personnel for consultation.
2	Other.

The "other" category in Table 3 included assistance by furnishing all literature, service information, and other printed materials on a specific brand of appliances needed for operation of a program. A comment by one manufacturer appeared to summarize the assistance by such organizations. The comment was: "We would prefer that assistance in new, or used, appliances be correlated with our distributors but we will help

in any manner possible to establish and operate this needed program."

An analysis of data derived from queries to appliance manufacturers indicates that they now employ appliance service technicians in several employment categories. They would prefer to have technicians with an educational background, including special training and skills beyond a high school diploma up to a college degree. Technicians trained in the proposed program would be acceptable for employment by appliance manufacturers and assistance in many ways would be offered for the establishment and operation of an appliance service technology program at the post-high school level.

The other phase of this study pertains to the determination of existant appliance service technician employment, need for trained technicians, type and qualifications of personnel, and assistance possible in the establishment and operation of an appliance service technology program at Lake Michigan College by the appliance distributors, retailers, and service organizations in the three Southwestern counties of Michigan and contiguous Northern Indiana. This is discussed in the next section.

The Appliance Distributors, Retailers, and Service Organizations

An important part of establishing any training program for a specific industrial or trade area is to first determine the need for such a program and then to formulate plans which will help satisfy this need.

This phase of the study was concerned with determining the feasibility of establishing an Appliance Service Technology Program at Lake Michigan College in Benton Harbor, Michigan and, therefore, included only appliance distributors, retailers, and service organizations in the three Southwestern counties of Michigan and contiguous Northern Indiana. The derived data from questionnaires and personal contact is pertinent only to this described locale and is presented below.

The first requested information was the number of persons now employed as Appliance Service Technicians in the area. This information was solicited by the question:

We now employ _____ Appliance Service Technicians.
(number)

Respondents to this question indicated that an accumulated total of 99 persons are now employed as appliance service technicians in the aforementioned geographical area. A reflection of part-time personnel, or so-called "Engineers" was not noted in the total; therefore, the number is deemed conservative.

An attempt to determine how many organizations would employ personnel as trained in the proposed programs, and acceptability of the programs, the second information request was made in the statement:

> We would employ Appliance Service Technicians as trained in the attached proposed training program. ( ) Yes ( ) No

Some 42 organizations indicated that they would employ technicians as trained in the proposed program. Combined with the comments and/or suggestions made on the proposed programs, to be presented later, it is evident that with some modifications of the program, the proposed training would be acceptable and even highly desirable.

An attempt to determine an estimated need for trained appliance service technicians in the area over a seven-year period, and the reason for these needs, two subsections of question number II were added to the questionnaire. If the answer to question II was yes (Appliance Service Technicians would be employed as trained in the proposed training program) then a request for information was made in the statements:

A. If yes, we anticipate the need in our organization to be:
   _____by 1966
   _____by 1967
   _____by 1968
   _____by 1972

B. The reason for these needs is due to:
   ( ) Replacement
   ( ) New employment and utilization
   ( ) Expansion of our organization

A summary of the derived information is shown in Table 4.

The data presented in Table 4 indicates an estimated need for trained appliance service technicians of some 203 over a seven-year period and the predominant reason for this need is anticipated expansion of existant organizations.

TABLE 4

ANTICIPATED NEED AND REASON FOR NEED
OF TRAINED APPLIANCE SERVICE TECHNICIANS
IN SOUTHWESTERN MICHIGAN AND NORTHERN INDIANA

Anticipated Need for Appliance Service Technicians				Reason for Need of Appliance Service Technicians (No. of Organizations)		
by 1966	by 1967	by 1968	by 1972	Replacement	New Employment & Utilization	Expansion of Organization
52	45	54	52	12	10	30

Following the forecasted need for trained appliance service technicians, an indication of how these organizations planned to utilize the trained technician was considered pertinent. Such an indication could have some bearing on the adoption of the final program offering. This information was sought from organizational reactions to the statement:

We would employ the trained technician as:
( ) Appliance serviceman
( ) Appliance service supervisor
( ) Shop-based repairman
( ) Salesman
( ) Office supervisor
( ) Other

Information derived from this solicitation is presented in Table 5.

TABLE 5

PROPOSED EMPLOYMENT OF TRAINED APPLIANCE SERVICE TECHNICIANS BY APPLIANCE DISTRIBUTORS, RETAILERS, AND SERVICE ORGANIZATIONS

Number of Organizations Proposing Employment of Trained Technician	Proposed Employment Category
43	Appliance Serviceman
7	Appliance Service Supervisor
10	Shop-based Repairman
15	Salesman
1	Office Supervisor

Results shown in Table 5 indicate that the majority (43) of organizations

propose to employ the trained appliance service technician as an appliance serviceman but a concensus seems evident that the proposed training would qualify the trained technician to be employed in many phases of the appliance industry. This is one of the intended objectives of the training program.

Personal characteristics deemed desirable by appliance distributors, retailers, and service organizations for a potential appliance service technician employee was considered important for this study and a possible training program. Relative information was derived from the question:

> We consider the personal characteristics of a potential Appliance Service Technician employee to be:
>
> A. Age_____ to _____
> B. Sex: ( ) Male ( ) Female
> ( ) Either male or female
> C. Physical health and conditions
> ( ) Perfect health and ambulation
> ( ) Partial handicap
> ( ) Other

Data derived from the above question is summarized in Table 6.

Information shown in Table 6 indicates a preference for a male appliance service technician, 21-35 years of age, being of able body and mind to perform the varied duties expressed in Table 5, when trained as proposed.

Suggestions and comments on the proposed program were requested in the questionnaire by the statement:

TABLE 6

DESIRABLE PERSONAL CHARACTERISTICS OF A
POTENTIAL APPLIANCE SERVICE TECHNICIAN EMPLOYEE

Number of Organizations Expressing Preference	Preference Expressed
	<u>Age:</u>
52	21-35 years
20	35-55 years
	<u>Sex:</u>
46	Male
0	Female
1	Either male or female
	<u>Physical Health and Conditions:</u>
35	Perfect health and ambulation
12	Partial handicap
0	Other

Suggestions or comments on the attached proposed Appliance Service Technology Program.

Some of the suggestions and comments made were:

1. "Great need in the area for such a program."
2. "We will train our own."
3. "Use factory trained personnel."
4. "Need for more training hours."
5. "Definitely a step in the right direction to fill a big gap."
6. "The program is excellent. Would make jobs available for the mechanically-inclined and provide employees."
7. "Such personnel is needed."
8. "A good idea."
9. "Keep to the basics."
10. "We need trained servicemen now!"
11. "Trained service personnel becoming a necessity."
12. "Teach them a little finesse."
13. "We need servicemen!"
14. Etc.

The abovementioned comments typify the reaction to a discussion on training of appliance service technicians in the area. Broad implications and suggestions were made which will be incorporated in the finalization of the program to be offered and will be a part of the next phase of the project.

With the apparent stigma attached to vocational or occupational programs, and some difficulty experienced in getting students into some of these programs, it was considered important to solicit aid from organizations in either helping recruit students and/or to send some of their own employees for training. Therefore, a request was made for an estimation of employees that could be sent for training, on what basis,

and the number per year over a three-year period. This request was made with the question:

We would send employees for training.
( ) Yes ( ) No
A. If yes, we would send these employees on:
( ) Full-time basis (expenses paid)
( ) Full-time-released basis
( ) Other
B. The number that would, or could, be sent for training is:
_____in 1966-67
_____in 1967-68
_____in 1968-69

The results of this request are summarized in Tables 7 and 8.

TABLE 7

EMPLOYEES THAT COULD BE SENT FOR TRAINING

Number of Organizations that will send Employees for Training	Basis on which Employees would be sent
	Basis
5	Full-Time basis (expenses paid)
5	Full-Time-Released basis
14	Other

Some 24 organizations stated that they would, or could, send employees for training in the proposed program and, as indicated in Table 7, five

organizations would send employees on a full-time (expenses paid) and a full-time-released basis. Some 14 would send employees on an "other" basis which was in all cases on a part-time basis (evening preferred).

Table 8 presents the number of employees that would, or could, be sent for training over a three-year period.

TABLE 8

EMPLOYEES THAT COULD, OR WOULD, BE SENT FOR TRAINING

Number	Year
14	1966-67
18	1967-68
14	1968-69

Assistance in obtaining students, as indicated in Table 8, for a new program can be the determination of the program offering and further stresses the need for such training.

Possible support in the initiation and operation of an up-to-date program is imperative since the latest appliance models, etc., are required in the laboratory. Therefore, an indication of what support may be available was sought in the statement and category selection:

> We would be willing to help Lake Michigan College initiate and operate the program.
> ( ) Yes ( ) No

A. Support would be:
( ) Used, or new, equipment or components for instructional and laboratory courses.
( ) Instructional aids (charts, cut-aways, etc.).
( ) New, or used, appliances for instructional demonstrations.
( ) Personnel for consultative services.
( ) Monetary grants.
( ) Recruitment of students.
( ) Other.

In response to the above query, there were 32 organizations who indicated a willingness to help Lake Michigan College initiate and operate the program. The means of support is summarized in Table 9.

TABLE 9

SUPPORT TO INITIATE AND OPERATE
AN APPLIANCE SERVICE TECHNOLOGY PROGRAM

Number of Organizations That Will Give Support	Means of Support
23	Used, or new, equipment or components for instructional and laboratory purposes.
11	Instructional aids (charts, cut-aways, etc.).
25	New, or used, appliances for instructional demonstrations.
11	Personnel for consultative services.
1	Monetary grants.
9	Recruitment of students.

With support from appliance distributors, retailers, and service organizations for the initiation and operation of an appliance service technology program as indicated in Table 9, a comprehensive, up-to-date, and well-equipped facility and program should be feasible.

The summary, conclusions, and recommendations of the study are included in Chapter IV.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the major findings of the investigation, contains the conclusions that may be drawn, and outlines recommendations for action that should be taken in the next phase of the project.

The purpose of this study was to:

1. Determine the acceptance by appliance manufacturers of appliance service technicians as employees, educational requirements of technicians, and acceptance of, or suggestions on, the proposed appliance service technology programs as developed for post-high school training.
2. Determine the number of appliance service technicians now being employed, the number needed over a seven-year period, employment of a technician as trained in the proposed programs, and possible interest in assisting in the initiation and operation of such a program by appliance distributors, retailers, and service organizations in Southwestern Michigan and contiguous Northern Indiana.

The proposed one- and two-year appliance service technology programs were developed after considerable correspondence with appliance manufacturers and associations relating to what is being done by these organizations in technician training so that the proposed post-high school programs would complement rather than duplicate efforts being expended. Visitations and correlation with the Emily Griffith Opportunity School of Denver, Colorado and Southern Colorado State College of Pueblo, Colorado, who are operating appliance service programs, were made to determine what is being done at those institutions. Also, a review was made of the program being offered by the University of Georgia.

Questionnaires were developed for solicitation of information relating to the purpose of this study.

An advisory committee was appointed and review of developed programs and questionnaires was made,after which, the questionnaires were mailed to appliance manufacturers, distributors, retailers, and service organizations. Personal contacts were also made soliciting information relative to need and proposed programs.

Evaluation of the progress and procedures of the study was done by Dr. Max Smith of Michigan State University in East Lansing, Michigan.

Summary of the Findings

A summary of the major findings in the study include:

1. Appliance manufacturers:

   a. Appliance service technicians are now being employed by 11 of these organizations.

   b. The majority of technicians are being employed as technical and/or field representatives followed by job descriptions of laboratory technicians, manufacturing processes, product design change analysts, and production employees in descending order.

   c. The educational requirements generally considered minimum by appliance manufacturers for appliance service technician employees is a high school diploma plus special training and skills.

   d. Some eight appliance manufacturers indicated that they would employ technicians trained as proposed.

   e. The proposed programs were generally considered as "good" to "excellent" with some

suggestions for enlargement of specific elements such as business fundamentals and practices and basic electricity.

f. Appliance manufacturers are most willing to assist in the initiation and operation of an appliance service technician training program. Offerings of appliances, instructional aids, consultative personnel, service information, and "any assistance that can be given" are exemplary.

2. Appliance distributors, retailers, and service organizations.

a. Some 99 technicians are presently employed in the Southwestern Michigan and contiguous Northern Indiana area.

b. Technicians trained as proposed would be desirable for possible employment as appliance servicemen, appliance service supervisors, shop-based repairmen, salesmen, and office supervisors.

c. The anticipated need for trained appliance service technicians in Southwestern Michigan and contiguous Northern Indiana is some 203

in the period from 1966 to 1972.

d. Desirable personal characteristics of a potential appliance service technician appears to be a male from 21 to 35 years of age, near perfect in health and ambulation.

e. The proposed training programs were generally considered adequate to fill a great "need" for trained personnel in the appliance service field. Suggestions for enlargement of the program will be incorporated into the final program in the next phase of the project. A general concensus was reached relative to a possible most desirable and effective program which is an enlargement of the proposed one-year program with a probable 52-60 week duration.

f. In order to assure adequate students for operation of the program and to upgrade presently employed technicians, some ten organizations have stated that they would send students on a full-time (expenses paid) and full-time-released basis while 14 other organizations

wish to send employees on a part-time basis. The number that could, or would, be sent for training are 14 in 1966-67, 18 in 1967-68, and 14 in 1968-69.

g. Some 32 organizations are willing to help establish an appliance service technology program at Lake Michigan College. The support would be in the form of new, or used, appliances, instructional aids, consultative personnel, monetary grant, and recruitment of students.

In general, the findings indicate agreement between appliance manufacturers and associations and the distributors, retailers, and service organizations on the need for appliance service technicians the educational requirements, beyond high school, of a technician, acceptability of the proposed training programs, and the available assistance to initiate and operate an appliance service technology program at the post-high school level.

Conclusions

The conclusions that can be drawn from the study and this phase of the project are:

1. There is a definite demanding need for trained appliance service technicians.

2. The desired profile of a trained appliance service technician is a male of some 21-35 years of age in sound health and mind and trained as proposed (with minor revisions and enlargements) at the post-high school level.
3. Localized appliance distributors, retailers, and service organizations would send employees on a full-time basis as well as employees on a part-time basis for training for entry into the field as well as for up-grading purposes.
4. Support for the initiation and operation of an appliance service technology program is available from appliance manufacturers as well as distributors, retailers, and service organizations. The type of support offered would make possible a dynamic, well-equipped, and up-to-date laboratory and program.

Any generalizations from this study regarding the need for appliance service technicians in the appliance distributors, retailers, and service organizations must be limited to the three counties of Southwestern Michigan and contiguous Northern Indiana.

Recommendations

It is recommended that:

1. The next phase of this project be allowed to proceed. Included in this phase should be the revision and enlargement of the proposed program and final adoption of same for offering and developing a guidebook which may serve as a guideline in establishing an appliance service technology program to individuals or institutions that are interested in doing so.
2. The Board of Trustees of Lake Michigan College of Benton Harbor, Michigan give serious and due consideration to the initiation and operation of an appliance service technology program at the earliest possible time to help fulfil a demanding need for trained personnel in the service area of the college.
3. Continued efforts be expended to enlarge and enhance communication and understanding between institutions of higher learning and the appliance and other industries in order to attempt solutions of the increasing problems of manpower training and retraining in our nation.

APPENDIX A

APPLIANCE SERVICE TECHNOLOGY ADVISORY COMMITTEE

G & M Appliances — Niles, Michigan
Jack Curtis, Service Manager

Indiana & Michigan Electric Company — Benton Harbor, Michigan
H. K. Morris, Personnel
Walt Appleget, Div. Service Coordinator

Maytag Company — Newton, Iowa
Bill Benson, Service Supervisor — Grand Rapids, Michigan

Michigan Gas Utilities Company — Benton Harbor, Michigan
Gene Lewis, Manager

Patton Brothers — Benton Harbor, Michigan
Louis Patton

Radio Equipment Company — South Bend, Indiana
Jack Andrews

Sears, Roebuck & Company — Benton Harbor, Michigan
Paul Kirchner, Customer Service Manager
Judson Marche, Assistant Store Manager

West Michigan Electric Company — Benton Harbor, Michigan
Bruce Radenbaugh, Service Manager

Whirlpool Corporation — Benton Harbor-St. Joseph, Michigan
Ted Miller, St. Joseph Division (Personnel)
Vince Miller, Educational Division

MANUFACTURERS

Mr. E. L. Vervoort, Chairman
Customer Service Committee
American Gas Association
195 Montague Street
Brooklyn, New York 11201

Mr. Herbert Phillips
Technical Director
American Home Laundry Manufacturers' Association
20 North Wacker Drive
Chicago, Illinois 60606

Mr. E. C. Carman
Director of Marketing
Avco Corporation
Aerospace Structures Division
Nashville, Tennessee 37202

Mr. Robert S. Geran
General Service Manager
American Motors Corporation
14250 Plymouth Road
Detroit, Michigan 48232

Mr. Stephen Upton
Vice President, Consumers Service
Whirlpool Corporation
Administrative Center
Benton Harbor, Michigan

Mr. L. O. Reese, President
Armstrong Products Corporation
P. O. Box 940
Huntington, West Virginia

Mr. E. B. Lawson, Manager
Service Department, Appliance Division
Blackstone Corporation
Jamestown, New York 14701

Mr. Thomas Scheirlow, Service Manager
Delco Products Division
General Motors Corporation
329 E. First Street
Dayton 1, Ohio

Mr. K. W. Bennett, General Supervisor
Service Training Department
Frigidaire
Dayton, Ohio 45401

Mr. A. F. Horn
General Electric Company
Building 6, Room 218
Appliance Park
Louisville 1, Kentucky

Mr. D. G. Kassner
Product Service Manager
Hamilton Manufacturing Company
Two Rivers, Wisconsin

Mr. W. G. McNeal, Manager
Product Service
Hotpoint
5600 West Taylor Street
Chicago, Illinois 60644

Mr. E. G. Davidson
Supervisor-Service Training
Norge Sales Corporation
National Service Department
Merchandise Mart Plaza
Chicago, Illinois 60654

Mr. Alex J. Tagnon
Field Service Manager
Philco Corporation
Parts & Service Department
"C" and Westmoreland Streets
Philadelphia, Pennsylvania 19134

Mr. M. Bartelt
Service Department
Speed Queen
Ripon, Wisconsin 54971

Mr. W. B. Creech
General Manager, Product Service
Westinghouse Electric Corporation
246 Fourth Street, East
Mansfield, Ohio 44902

Mr. Fran Susor, Manager
Service Training
The Maytag Company
Newton, Iowa 50208

Mr. Lloyd W. Sleezer
Easy Appliance Division
Hupp Corporation
1135 Ivanhoe Road
Cleveland, Ohio 44110

Mr. C. T. McClure
Franklin Appliance Division
Studebaker Corporation
65 22nd Avenue, N. E.
Minneapolis, Minnesota 55418

APPENDIX B

LAKE MICHIGAN COLLEGE
BENTON HARBOR, MICHIGAN 49022

OFFICE OF DEAN OF COMMUNITY SERVICES

March 25, 1965

Thank you for your consideration and invaluable assistance given me thus far in my attempts to ascertain the possible need for further post-high school Appliance Service Technology programs. I am still a long way from an analysis of the need but am hoping to make rapid progress now.

I would much appreciate your immediate completion of the enclosed questionnaire and your comments on the one- and two-year program proposals as I have composed them. The immediate return of the questionnaire is of prime importance.

Thank you again.

Sincerely,

Clarence H. Schauer

CHS:np

Enc./4

Information Relative To A Proposed
APPLIANCE SERVICE TECHNOLOGY PROGRAM
At
Lake Michigan College

Please indicate below your interests or comments relative to a proposed Appliance Service Technology Program at Lake Michigan College and return the completed form to Dr. C. H. Schauer, Dean of Community Services at Lake Michigan College, 711 Britain Avenue, Benton Harbor, Michigan. The source of individual comments will be considered confidential.

I. We now employ Appliance Service Technicians.

( ) Yes
( ) No

A. They are employed as:

( ) Laboratory technicians
( ) Product design change analysts
( ) In manufacturing processes
( ) Sales personnel
( ) Production employees
( ) Other: _____(specify)

II. Educational requirements for employment as an Appliance Technician are:

( ) Less than high school graduate
( ) Less than high school graduate plus special training and skills
( ) High school graduate
( ) High school graduate plus special training and skills
( ) Two years of college
( ) Two-year community college associate degree in technology
( ) College graduate
( ) Other: _____(specify)

III. We would employ a Technician with training beyond high school as outlined in the attached proposed Appliance Service Technology Program.

( ) Yes
( ) No

IV. Suggestions or comments on the attached proposed Appliance Service Technology Program:

_____

_____

_____

V. We would help establish and operate the proposed Program by providing:

( ) New, or used, appliances and/or components for laboratory instruction and student manipulation
( ) Instructional aids (cut-aways, charts, flow and wiring diagrams, etc.)
( ) New, or used, appliances for instructional and demonstration purposes
( ) Monetary grants
( ) Specialized personnel for consultation
( ) Students or recruitment of students
( ) Other: _____(specify)

SIGNED: _____(Name)

_____(Company)

_____(Address)

_____(City & State)

LAKE MICHIGAN COLLEGE
BENTON HARBOR, MICHIGAN 49022

OFFICE OF DEAN OF COMMUNITY SERVICES

April 1, 1965

With an increasing complexity of mechanisms and controls in home appliances and an evident need for service technicians, we at Lake Michigan College are exploring the possible need for such technicians in our area with post-high school training as well as the possibility of offering an Appliance Service Technology Program. Your expressed interests, comments, and estimates are invaluable in our planning to be of more and better service to you and your industry.

The completion and immediate return of the enclosed questionnaire will be most appreciated.

Thank you.

Sincerely,

Clarence H. Schauer

CHS:np

Enc.

Information Relative To A Possible
APPLIANCE SERVICE TECHNOLOGY PROGRAM
At
Lake Michigan College

Please indicate below your interests, comments, and estimations relative to a possible program for Appliance Service Technicians and return the completed form to Dr. C. H. Schauer, Dean of Community Services at Lake Michigan College, 711 Britain Avenue, Benton Harbor, Michigan. The source of individual answers and comments will be considered confidential.

I. We now employ _____ (number) Appliance Service Technicians.

II. We would employ Appliance Service Technicians as trained in the attached proposed Training Program.

( ) Yes
( ) No

A. If yes, we anticipate the need in our organization for such Technicians to be:

_____by 1966
_____by 1967
_____by 1968
_____by 1972

B. The reason for these needs is due to:

( ) Replacement
( ) New employment and utilization
( ) Expansion of our organization

III. We would employ the trained Technician as:

( ) Appliance serviceman
( ) Appliance service supervisor
( ) Shop-based repairman
( ) Salesman
( ) Office supervisor
( ) Other: _____(specify)

IV. We consider the personal characteristics of a potential Appliance Service Technician employee to be:

A. Age: _____ to _____

B. Sex: ( ) Male ( ) Female ( ) Either male or female

C. Physical health and conditions

( ) Perfect health and ambulation
( ) Partial handicap
( ) Other: _____

_____(specify)

V. Suggestions or comments on the attached proposed Appliance Service Technology Program:

_____

_____

_____

VI. We would send employees for training.

( ) Yes
( ) No

A. If yes, we would send these employees on:

( ) Full-time basis (expenses paid)
( ) Full-time-released basis
( ) Other: _____(specify)

B. The number that would, or could, be sent for training is:

_____in 1966-67
_____in 1967-68
_____in 1968-69

VII. We would be willing to help Lake Michigan College initiate and operate the Program.

( ) Yes
( ) No

A. Support would be:

( ) Used, or new, equipment or components for instructional and laboratory purposes
( ) Instructional aids (charts, cut-aways, etc.)
( ) New, or used, appliances for instructional demonstrations
( ) Personnel for consultative services
( ) Monetary grants
( ) Recruitment of students
( ) Other: _____(specify)

SIGNED: _____(Name)

_____(Position or Title)

_____(Company)

_____(Address)

_____(City & State)

LAKE MICHIGAN COLLEGE
BENTON HARBOR, MICHIGAN 49022

OFFICE OF DEAN OF COMMUNITY SERVICES

April 23, 1965

A letter and questionnaire regarding the possible offering of an Appliance Service Technology Program at Lake Michigan College was sent to you on April 1, 1965 asking your expressed interests, comments, and estimates which are invaluable in our planning. To date, we have not heard from you so we are again enclosing another copy of the questionnaire which we hope can be completed and returned immediately.

We at Lake Michigan College are endeavoring to be of better service to you in your industry by studying the feasibility of originating such a program. Thank you.

Sincerely,

Clarence H. Schauer

CHS:np

Enc. 3

APPENDIX C

PROPOSED ONE-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

Courses	Hours
Communication Skills	50
Business Principles and Practices	80
Warranties, Service Policies, etc.	20
Customer and Job Relations	70
Merchandising and Warehousing	10
Mathematics	100
Basic Electricity	160
Basic Chemistry, Physics, and Thermodynamics	80
Mechanisms and Controls	80
Appliance Servicing	670
Total	1320

CURRICULUM GUIDE

COMMUNICATION SKILLS

The purpose of this course is to provide the principles of communication skills of English and speech to an individual to help make him a more-effective communicator as a businessman or employee in Appliance Service.

Classwork	Related Information
English	
1. Review of the fundamentals of English	1. Grammar 2. Spelling 3. Punctuation 4. Capitalization 5. Etc.
2. Vocabulary building	1. Exercises in word usage, sentence structure, etc.
3. Report and letter writing	1. Reports on laboratory experiments and appliance servicing 2. Personal letter writing, business letter writing, applications, etc.
Speech	
1. Introduction to informal and formal speaking	1. Basic principles of effective speaking
2. Application of basic principles and practices of effective speaking	1. Speaking in informal and simulated formal situations

CURRICULUM GUIDE

WARRANTIES, SERVICE POLICIES, ETC.

The purpose of this course is to provide a basic understanding of warranty and service policies on home appliances as may be encountered by an appliance serviceman, a businessman, or an employee.

Classwork	Related Information
Warranties	
1. Warranties on appliances	1. General content 2. Obligation of manufacturer 3. Obligation of retailer 4. Service responsibilities 5. Customer responsibilities
2. Escalation on parts and service	1. Parts and service covered within a specific time period 2. Customer and manufacturer responsibility
Service Policies	
1. Service policies on appliances	1. General content 2. How are they sold 3. Service responsibilities for manufacturer and retailer 4. Customer responsibilities

CURRICULUM GUIDE

CUSTOMER AND JOB RELATIONS

The purpose of this course is to provide a basic understanding of the human relationships, personality adjustments, and attitudes of individuals in customer service and sales environments and with fellow workers.

Classwork	Related Information
Customer Relations	
1. The sales climate	1. Mental attitude 2. Physical appearance 3. First impressions 4. Knowledge of service 5. Knowledge of product 6. Interest in customer 7. Closing 8. Case studies
2. The service climate	1. Mental attitude 2. Physical appearance 3. Knowledge of product 4. Customer's story 5. Professional approach 6. Home etiquette 7. Service charges 8. A "thank you" 9. Case studies
Job Relations	
1. Getting along with people	1. Mental attitude 2. Enthusiasm 3. Temper 4. Reliability 5. Giving and receiving constructive criticism 6. Faith and trust in company and co-workers 7. Physical appearance 8. Case studies

CURRICULUM GUIDE

MERCHANDISING AND WAREHOUSING

The purpose of this course is to provide a basic understanding of the principles of good merchandising for increased sales and service and of warehousing appliances and parts.

Classwork	Related Information
Merchandising	
1. Prices, discounts, profits, etc.	1. Purchase prices, mark-up, profits 2. Service costs 3. Interest on monies borrowed for operations or inventories
2. Merchandise design and display	1. Principles of display, design and installation 2. Factors related to consumer selection
3. Advertising and sales promotion	1. Principles of advertising in promoting merchandise
Warehousing	
1. Utilization of space	1. Space for appliances 2. Parts storage
2. Inventory	1. Card and file indices 2. Revolving inventory 3. Best utilization of money and space

CURRICULUM GUIDE

BUSINESS PRINCIPLES AND PRACTICES

The purpose of this course is to provide the principles and practices of business in: (1) economics, (2) accounting, (3) marketing, and (4) salesmanship, which should help make an individual a more effective businessman or employee in the appliance industry.

Classwork	Related Information
Economics	
1. Principles of Economics	1. Economic organization and growth 2. Supply and demand 3. The full-employment theory of interest and profits 4. Money and the nature of credit 5. The problem of inflation and control 6. Business--cycle, theory, and control 7. National income, production, and employment 8. The Federal Reserve System and money supply 9. Labor unions and collective bargaining 10. Tax structure 11. The role of government and business
Accounting	
1. Principles of Accounting	1. Recording, analyzing, and interpreting financial statements 2. Accounting procedures 3. Problems

Marketing

1. Basic principles and practices in marketing	1. Commodity approach to buying and selling 2. Institutions in the marketing system 3. Buying, selling, transporting, storing, grading, financing, etc. 4. Customer satisfaction and profit

Salesmanship

1. Fundamentals of Salesmanship	1. Needs of salesmanship 2. Tools of salesmanship 3. Creative selling 4. The sales atmosphere 5. Traits of a salesman 6. Experience

CURRICULUM GUIDE

MATHEMATICS

The purpose of this course is to provide a review of basic mathematics and to introduce and apply algebraic functions and trigonometry.

Classwork	Related Information
1. Review of basic mathematics	1. Common fractions 2. Decimal fractions 3. Powers and roots 4. Applications
2. Algebraic and trigonometric functions	1. One and two unknowns 2. Simultaneous equations 3. Trigonometric relationships 4. Slide rule 5. Applications

CURRICULUM GUIDE

BASIC ELECTRICITY

The purpose of this course is to introduce the basic elements of electrical theory and applications.

Classwork	Related Information
1. General introduction	1. Electron theory 2. Sources and production of electricity 3. Electrical symbols 4. Basic circuitry
2. Ohm's Law	1. Relationship between voltage, amperage, and resistance 2. Applications
3. Magnetism and electromagnetism	1. Magnetism and electric current 2. Electromagnets
4. Principles of D-C current	1. Ohm's Law 2. Series circuits 3. Parallel circuits 4. Multiple circuits 5. Power 6. Wire sizes 7. Voltage drop and line losses 8. I-R drop and line losses 9. Electromagnetism 10. Magnetic circuit 11. Electromagnetic induction 12. Capacitance 13. Instruments 14. Laboratory applications
5. Principles of A-C current	1. Fundamentals of A-C current 2. Inductance and inductive reactance 3. Capacitance and capacitive reactance

4. Series circuits
   a. Resistance and inductance
   b. Resistance and capacitance
   c. Resistance, inductance, and capacitance
5. Parallel circuits
   a. Inductance
   b. Inductance and capacitance
6. A-C power and power factor
7. A-C single phase power
8. A-C polyphase power
9. Wye and Delta systems
10. Single-phase, three-wire installations
11. Three-phase, three-wire installations
12. Electromagnetism
13. Laboratory applications

6. Circuit drawings

1. D-C circuits
2. A-C circuits
   a. Single phase
   b. Three phase

CURRICULUM GUIDE

BASIC CHEMISTRY, PHYSICS, AND THERMODYNAMICS

The purpose of this course is to provide the basic information needed in the principles of electricity, refrigeration, and appliance operation efforts.

Classwork	Related Information
Chemistry	
1. Basic chemistry	1. Valence theory 2. Basic reactions 3. Effects of detergents, bleaches, etc. 4. Water chemistry 5. Corrosion 6. Combustion 7. Laboratory applications
Physics	
1. Basic physics	1. Work 2. Mechanical advantage 3. Magnetism 4. Electricity and electromagnetism 5. Specific heat 6. Latent heat 7. Heat of combustion 8. Heat of compression 9. Heat of vaporization 10. Laboratory applications
Thermodynamics	
1. Basic thermodynamics	1. Effects of compression of gases in refrigeration 2. Effects of vaporization in refrigeration 3. Expansion of liquids and gases 4. Effect of temperature 5. Laboratory applications

MECHANISMS AND CONTROLS

It is the purpose of this course to introduce the various mechanisms and controls and explain their operations as found in varied appliances.

Classwork	Related Information
Mechanisms	
1. Theory and structure of appliance mechanisms	1. Motors 2. Transmissions 3. Timers 4. Solenoids 5. Heating elements and burners 6. Ignition (gas) 7. Compressors 8. Fans and blowers 9. Pumps 10. Laboratory applications
Controls	
1. Theory and operation of appliance controls	1. Timers 2. Motor speed 3. Switches 4. Thermostats 5. Humidity 6. Overload protection 7. Temperature 8. Water levels 9. Laboratory applications

APPLIANCE SERVICING

The purpose of this course is to develop a thorough understanding of the installation, operation, safety procedures, diagnosing problems, and servicing electrical and gas home appliances.

Classwork	Related Information
Washers	
1. Installation procedures	1. Location relative to power supply, water supply, and drainage 2. Leveling 3. Grounding 4. Voltage, water pressure and temperature tests 5. Drain capacity and operation
2. Safety procedures	1. Proper grounding of the appliance according to local codes 2. Proper water connections 3. Proper power requirements 4. Disconnect power source to service appliance 5. Etc.
3. Operating procedures	1. Test run and time the operation 2. Instruction of customer on use of the washer--proper loading, soap, clothes to be washed, bleaches, and general operation of the timer and the appliance.
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each electrically-operated component

	4. Remove, test, repair, and replace the electrical components 5. Procedures for locating electrical troubles 6. Laboratory applications of electrical problem diagnosis and remedy
5. Diagnosing and servicing the water systems	1. Interpretation and tracing of water flow diagrams 2. Function of each water system component 3. Remove, test, repair, and replace components 4. Procedures for diagnosing and locating problems in the water system 5. Laboratory applications of water system problem diagnosis and remedy
6. Diagnosing and servicing the mechanical system	1. Operational characteristics and sequences 2. Functions of each component 3. Dismantle, inspect, repair, and replace bearings, rollers, etc. of the entire mechanical system 4. Test run 5. Procedures for locating mechanical problems 6. Laboratory applications

Dryers

1. Installation procedures	1. Location relative to power supply, gas, water, and vent 2. Leveling 3. Grounding 4. Test voltage and ground

2. Safety procedures	1. Proper electrical supply and ground, according to local codes 2. Grounding according to local codes 3. Test safety components on the appliance 4. Power and gas to be disconnected before service work is attempted
3. Operating procedures	1. Test run and time the operation 2. Instruction of customer on usage of the appliance--proper loading, type of clothes, degree of drying, and general operation and care of the appliance
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each electrically-operated component 4. Remove, test, repair, and replace the electrical components 5. Procedures for locating electrical problems 6. Laboratory applications for locating and diagnosing electrical problems
5. Diagnosing and servicing the gas system on a gas dryer	1. Check electrical system and components applicable to the operation of the gas system as above 2. Interpretation of the gas flow diagrams 3. Functions of each gas system component

4. Operational characteristics and sequences
5. Gas burners, combustion, and adjustment of the air-fuel mixtures
6. Ignition--electrical or standing pilot
7. Orifice requirements for natural, manufactured, and LP gases. Conversion possibilities from one to the others
8. Proper combustion venting of the appliance
9. Remove, test, repair, and replace the gas system components
10. Testing for, locating, and remedying gas leak problems in the system
11. Check and set incoming gas line pressures
12. Procedures for locating and diagnosing gas system problems
13. Laboratory applications for gas system analysis and service

6. Diagnosing and servicing the air and water systems

1. Interpretation of air and water flow diagrams
2. Function of each component
3. Remove, test, repair and replace components
4. Procedures for diagnosing and locating problems in the air and water systems
5. Laboratory applications of air and water systems problem diagnosis and remedies

7. Diagnosing and servicing the mechanical system	1. Operational characteristics and sequences 2. Function of each component and part 3. Disassemble, inspect, repair, and replace all parts and components of the mechanical system 4. Test run 5. Procedures for locating mechanical problems 6. Laboratory applications

Ranges

1. Installation procedures	1. Locate power or gas supply 2. Test voltage on power supply and gas pressure on gas supply 3. Install electrical card and/or gas supply 4. Level 5. Ground 6. Test for voltage at range and for leaks, etc. of gas
2. Safety procedures	1. Ground according to local codes 2. Check fusing or circuit breaker size 3. Disconnect power supply and/or gas for servicing
3. Operating procedures	1. Test surface units and oven element in electric ranges 2. Light the pilots and check operation of gas burners. Adjust fuel-air mixtures 3. Check and adjust automatic controls on oven and burners 4. Check operation of timers 5. Instruct user on proper usage of the range and proper utensils and methods

4. Diagnosing and servicing the range	1. Interpretation of electrical and gas systems 2. Operational characteristics and sequences of components 3. Functions of each component 4. Remove, test, repair, and replace all components 5. Procedures for locating problems 6. Laboratory applications in diagnosis and remedy of problems

Water Heaters

1. Installation procedures	1. Locate power and/or gas supply 2. Placement as near to kitchen and bathroom as possible 3. Install power, gas, and ground connections according to local codes 4. Install plumbing connections according to code 5. Level 6. Proper venting of the gas appliance
2. Safety procedures	1. Check wire sizes, fuses, circuit breakers, gas supply, vent, etc. 2. Check limit temperature controls 3. Check operation of temperature-pressure relief valve 4. Check operation of 100% safety cut-off units of gas appliance 5. Check vent efficiency
3. Operation procedures	1. Check and test heating elements, burners, and pilot lights 2. Test and set thermostatic-temperature controls 3. Instruct user on operation of the appliance

4. Diagnosing and servicing the water heater system	1. Interpretation of electrical, gas, and water diagrams and systems 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls and components 4. Test and replace tank 5. Test for water and gas leaks 6. Procedures for locating troubles 7. Laboratory applications

Refrigerators-Freezers

1. Installation procedures	1. Locating power and/or gas supply 2. Locating heating registers, radiators, etc. 3. Placement and leveling of appliance 4. Test power and/or gas supply 5. Installation, connection and test of gas connections when applicable. Set pilot and burner fuel-air mixture
2. Safety precautions	1. Check fuses and circuit breakers on electrical power supply and gas pressures and leakage in gas system 2. Proper grounding where required 3. Power and/or gas disconnection or shut-off prior to service
3. Operation procedures	1. Checking and testing of refrigeration system 2. Test thermostat 3. Test run the appliance 4. Instruct user on operation and care of appliance

4. Diagnosing and servicing the electrical and/or gas system	1. Interpretation of electrical and/or gas system diagrams 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls and components 4. Test for gas leaks, etc. 5. Procedures for locating troubles 6. Laboratory applications
5. Diagnosing and servicing the refrigeration system	1. Operational analysis of the refrigeration system 2. Remove, test, repair, and replace compressors, hydrators, expansion valves, condensors, evaporators, etc., and recharge the system 3. Testing and running the system 4. Procedures for locating troubles 5. Laboratory applications of diagnosis and remedy of troubles

Room Air Conditioners

1. Determination of capacity needs for a room, etc.	1. Heat conductivity through windows, doors, walls, etc. 2. Insulation 3. Area or volume to be cooled 4. Exposure to sun of area to be cooled 5. Occupants 6. Sizing of unit
2. Installation procedures	1. Locating unit in room relative to sun exposure on unit 2. Locating unit relative to circulation of outside air for condensor cooling 3. Locating unit relative to cool air circulation within area to be cooled

	4. Location of power supply 5. Location in properly-sized window 6. Installation of unit 7. Test of voltage in power source 8. Test run 9. Instruction of user on operation
3. Safety precautions	1. Fuses, circuit breakers, and wire sizes 2. Grounding per code 3. Power disconnected before and during service work
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical system diagrams 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls, relays, etc. 4. Procedures for locating troubles 5. Laboratory applications
5. Diagnosing and servicing the refrigeration and mechanical systems	1. Interpretation of the refrigeration cycle diagram 2. Operational analysis of the refrigeration cycle 3. Remove, test, repair, and replace compressor, blower, condensors, evaporators, expansion valves, etc. and recharging the system 4. Leak detection and operation 5. Procedures for locating troubles 6. Laboratory applications
Heating	
1. Determination of capacity needs for a home	1. Heat conductivity through buildings and building materials 2. Area or volume to be heated

	3. Sizing of heating unit 4. Sizing and placement of burner unit, blower, and ducting. Location of warm outlets and cold air returns
2. Installation of system	1. Power and fuel requirements and installation to the unit 2. Location of heating unit 3. Installation of ducting 4. Thermostat location 5. Test run 6. Instruction of user
3. Safety precautions	1. Fuses, wire sizes in power source 2. Fuel supply location, volume, and shut-off 3. Operation of 100% safety shut-off equipment 4. Fire extinguishers 5. Fire regulations on location of unit and service
4. Diagnosing and servicing the heating unit	1. Interpretation of electrical and fuel system diagrams 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace components 4. Procedures for locating and remedying troubles 5. Laboratory applications

Dishwashers

1. Installation procedures	1. Location of power and water supplies 2. Location of proper drain

	3. Voltage, water pressure-temperature tests 4. Leveling 5. Grounding 6. Instruction of user
2. Safety procedures	1. Grounding and wiring per local codes 2. Plumbing per local codes 3. Proper power, water, and drain connections 4. Disconnecting power before servicing
3. Operating procedures	1. Test run and time the operation 2. Instruction of user on proper usage of the appliance, detergents, etc.
4. Diagnosing and servicing the appliance	1. Interpretation of electrical, mechanical, and water diagrams 2. Operational characteristics and sequences of all systems 3. Functions of all components 4. Remove, test, repair, and replace the components 5. Procedures for locating problems 6. Laboratory applications

Food Waste Disposers

1. Installation procedures	1. Power supply and proper drain size and location 2. Proper sink adaptation
2. Safety precautions	1. Proper grounding per code 2. Plumbing and electrical per code 3. Accessible shut-off switch 4. Instruction of user in safe operation

3. Diagnosing and servicing the appliance	1. Operational characteristics 2. Functions of each component 3. Remove, test, repair, and replace components 4. Procedures for locating problems 5. Laboratory applications

Percolators, Toasters, Irons, and Grills

1. Safety procedures	1. Power requirements 2. Cords, shrouds, etc. 3. Servicing with power disconnected
2. Operating procedures	1. Test run and time the operation 2. Instruction of user on proper utilization of the appliance
3. Diagnosing and servicing the appliance	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each component 4. Remove, test, repair or adjust, and replace components 5. Procedures for locating troubles 6. Laboratory applications

Mixers, Fans, and Vacuum Cleaners

1. Safety procedures	1. Power requirements 2. Cords, shrouds, etc. 3. Servicing with power disconnected
2. Operating procedures	1. Test run 2. Instruction of user on utilization of the appliance

3. Diagnosing and servicing

1. Operational characteristics
2. Functions of components
3. Remove, test, repair or adjust, and replace components
4. Procedures for locating troubles
5. Laboratory applications

TWO-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

First Year

Semester I		Credit Hours
101a	English Composition	3
S185	Technical Algebra	3
ET151	Fundamentals of Electricity	5
A101	Mechanisms & Controls	3
S190	Technical Chemistry	2
		16

Semester II		Credit Hours
101b	English Composition	3
S186	Plane Trigonometry	3
ET152	Electricity-Electronics	5
DT145a	Drawing	2
A103	Appliance Servicing I	3
		16

Summer Term I		Credit Hours
A104	Appliance Servicing II	6
101	Fundamentals of Speech	3
		9

Second Year

Semester I		Credit Hours
Bus.Ad.104	Salesmanship	3
S290	Technical Physics	2
A203	Appliance Servicing III	6
Bus.Ad.101	Practical Accounting	3
MT165	Manufacturing Processes	2
		16

Semester II		Credit Hours
G279	Industrial Psychology	2
Bus.Ad.209	Marketing	3
A204	Appliance Servicing IV	6
Bus.Ad.211	Principles of Management	3
101	Political Science	3
		17

Summer Term II		Credit Hours
A303	Appliance Servicing V	6
		6